REMARKS

Applicants appreciate the Office Action of November 4, 2003. Applicants submit that Amended independent Claim 1 is patentable over the cited reference for at least the reasons discussed herein. Applicants have canceled Claim 6 from the present application and incorporated the recitations of Claim 6 into Amended Claim 1. Furthermore, Applicants submit that dependent Claim 7 is separately patentable over the cited reference, as the 103 rejection is improper. Accordingly, Applicants submit that the pending Claims are in condition for allowance, which is respectfully requested in due course.

Amended Claim 1 is Patentable over the Cited Reference

Claims 1-5 and 10-12 stand rejected under 35 U.S.C. § 102(e) as being anticipated by United States Patent No. 6,326,315 to Uchiyama *et al.* (hereinafter "Uchiyama"). Applicants respectfully submit that many of the recitations of these claims are neither disclosed nor suggested by the cited reference. For example, Amended Claim 1 recites:

> An integrated circuit ferroelectric memory device, comprising:
> an integrated circuit transistor having a source region and a drain region;
> a ferroelectric capacitor on the integrated circuit transistor having first and second sidewalls, the ferroelectric capacitor including a **first electrode consisting of a single material** adjacent the transistor, a second electrode remote from the transistor and a ferroelectric film therebetween;
> **a contact plug directly connected to the first electrode that electrically couples the ferroelectric capacitor to the source region of the integrated circuit transistor;**
> an insulating layer on the first and second sidewalls of the ferroelectric capacitor, the insulating layer having a surface that is substantially coplanar with an upper surface of the second electrode;
> a plate line directly on the ferroelectric capacitor a plate line directly on the ferroelectric capacitor; and
> **a stripe line adjacent the second electrode and remote from the first electrode**.

Applicants respectfully submit that at least the highlighted portions of, for example, Amended Claim 1, are neither disclosed nor suggested by Uchiyama for at least the reasons discussed below.

The Office Action states that Figure 1 of Uchiyama discloses all of the recitations of, for example, Claim 1. *See* Office Action, page 2. As discussed in Uchiyama:

> A first interlayer dielectric layer (ILD) 116 made of BPSG (boron-doped phospho-silicate glass) is formed on substrate 102 and field oxide region 104. ILD 116 is patterned to form vias 117, 118 to source region 106 and drain region 108, respectively. Vias 117, 118 are filled to form plugs 119, 120, respectively. Plugs 119, 120 are electrically conductive and typically comprise polycrystalline silicon. **A diffusion barrier layer 121 is formed and patterned on ILD 116 to be in electrical contact with plug 120. The diffusion barrier layer 121 is made of, for example, titanium nitride, and typically has a thickness of 10 nm to 20 nm. Diffusion barrier layers, such as titanium nitride, inhibit the diffusion of chemical species between the underlying and overlying layers of the memory 100.**
>
> As depicted in FIG. 1, **a bottom electrode layer 122 made of platinum and having a thickness of 100 nm is deposited on diffusion barrier layer 121.** Then a ferroelectric thin film 124 of layered superlattice material is formed in accordance with the invention on bottom electrode layer 122. A top electrode layer 126, made of platinum and having a thickness of 100 nm, is formed on ferroelectric thin film 124.

See Uchiyama, column 5, line 58 to column 6, line 11. In other words, Uchiyama discusses a diffusion barrier layer 121 between the plug 120 and a bottom electrode layer 122 of the ferroelectric capacitor. With respect to this argument, the Office Action states:

> Applicant's arguments are not persuasive because Uchiyama clearly discloses a contact plug (120) directly connected to the first electrode (121 and 122) that electrically couples the ferroelectric capacitor to source region (108) of the integrated circuit transistor (citations omitted). It is noted that the diffusion barrier layer (121) is a part of the first electrode because the diffusion barrier layer (121) is a conductive material (TiN).

See Office Action, page 5, paragraph 6, Response to Arguments. Applicants respectfully disagree. The diffusion barrier layer 121 is made of a different material than the bottom electrode layer 122 and serves a specific purpose in the device, namely, inhibiting "the diffusion of chemical species between the underlying and overlying layers of the memory 100." However, to expedite allowance of the present application, Applicants have Amended Claim 1 to recite "a first electrode consisting of a single material." Nothing in Uchiyama discloses or suggests a contact plug directly connected to a first electrode consisting of a single material as recited in Amended Claim 1. Furthermore, the plug 120 electrically connects the diffusion barrier layer 121 to the drain 108 of the transistor. In contrast, for

example, Amended Claim 1 of the present invention recites **a contact plug directly connected to the first electrode consisting of a single material that electrically couples the ferroelectric capacitor to the source region of the integrated circuit transistor.** Accordingly, nothing in the cited reference appears to disclose or suggests the highlighted recitations of, for example, Amended Claim 1.

Furthermore, Claim 1 has been further amended to include the recitations of dependent Claim 6, which has been canceled from the present application. In particular, Amended Claim 1 recites **a stripe line adjacent the second electrode and remote from the first electrode**. As stated in the Office Action, a stripe line as recited in Amended Claim 1 is not disclosed or suggested by Uchiyama. *See* Office Action, page 4, paragraph 5. Furthermore, as discussed below with respect to the 103 rejections, Jung cannot be properly used to reject Claims 6 and 7 as Jung and the present application were, at the time the invention was made, owned by, or subject to an obligation of assignment to, the same entity. Accordingly, Amended Claim 1 is patentable over the cited references for at least these additional reasons.

Accordingly, Amended Claim 1 is patentable over the cited references for at least the reasons discussed above. Furthermore, dependent Claims 2-5, 7 and 10-12 are patentable at least per the patentability of Independent base Claim 1, from which they depend. Accordingly, Claims 1-5, 7 and 10-12 are in condition for allowance, which is respectfully requested in due course.

The 103 Rejection is Improper

Claims 6 and 7 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Uchiyama in view of United States Patent No. 6,326,315 to Jung *et al.* (hereinafter "Jung"). Applicants respectfully submit that Jung is not a proper § 103 reference, and therefore, Applicants request the rejection under § 103 be removed for the reasons discussed below.

Jung and the present application were, at the time the invention was made, owned by, or subject to an obligation of assignment to, the same entity. *See* Assignment of the present application and copy of the cover sheet of the issued U.S. Patent to Jung indicating Samsung

as the Assignee, both of which are attached hereto. The present application was filed after November 29, 1999. For applications filed on or after November 29, 1999, a rejection under 35 U.S.C. §§ 102(e)/103 is not proper if evidence is presented that the prior art reference and the application were owned by the same person, or subject to an obligation of assignment to the same person, at the time the invention was made. *See* M.P.E.P. §§ 706.02(l)(1) and 2136.01. A statement by an attorney or agent of record to the effect that the application and reference were, at the time the invention was made, owned by, or subject to an obligation of assignment to, the same person is sufficient evidence to establish common ownership. *See* M.P.E.P. § 706(l)(2). The foregoing arguments are not to be considered a representation, concession or acquiescence as to the obviousness of the claimed invention in view of Jung. Thus, Applicants respectfully request that the 103 rejection with respect to Claims 6 and 7 be withdrawn.

Applicants have canceled Claim 6 from the present application and incorporated the recitations of Claim 6 into independent Claim 1, and therefore submit that Amended Claim 1 is also patentable for at least these reasons. Accordingly, Amended Claim 1 and Claim 7 are in condition for allowance, which is respectfully requested in due course.

Many of the Dependent Claims are Patentable

As discussed above, the dependent claims are patentable at least per the patentability of the independent base claim from which they depend. Furthermore, many of the dependent claims are also separately patentable.

For example, Claim 7 recites "A device according to Claim 1, wherein the stripe line comprises aluminum." As stated in the Office Action, Ochiyama does not teach an aluminum stripe line adjacent the second electrode remote from the first electrode as recited in dependent Claim 7 of the present invention. *See* Office Action, page 4, paragraph 5. Accordingly, the recitations of Claim 7 are not disclosed or suggested by the cited reference and, therefore, Claim 7 is separately patentable over the cited reference.

CONCLUSION

Applicants have amended Claim 1 and, therefore, submit that Amended Claim 1 and the claims that depend therefrom are patentable over the cited reference for at least the reasons discussed above. Applicants also submit that many of the dependent claims are also independently patentable. Thus, Applicants respectfully submit that the above-entitled application is in condition for allowance. If, in the opinion of the Examiner, a telephonic conference would expedite the examination of this matter, the Examiner is invited to call the undersigned attorney at (919) 854-1400.

It is not believed that an extension of time and/or additional fee(s)-including fees for net addition of claims-are required, beyond those that may otherwise be provided for in documents accompanying this paper. In the event, however, that an extension of time is necessary to allow consideration of this paper, such an extension is hereby petitioned under 37 C.F.R. §1.136(a). Any additional fees believed to be due in connection with this paper may be charged to our Deposit Account No. 50-0220.

Respectfully submitted,

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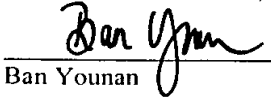
I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Mail Stop Non Fee Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on February 3, 2004.



Ban Younan

Attorney Docket No. 5649-926

ASSIGNMENT

THIS ASSIGNMENT, made by us, **Hyun-Ho Kim**, citizen of the Republic of Korea, residing at 102-506, Hanguk Apt., Poongdukcheon-ri, Suji-eub, Yongin-shi, Kyunggi-do, Republic of Korea; and **Ki-Nam Kim**, citizen of the Republic of Korea, residing at 108-502, Life Apt., Kkum Town, Pyeongchon-dong, Dongahn-ku, Anyang-shi, Kyunggi-do, Republic of Korea;

WITNESSETH: That,

WHEREAS, we are the joint inventors of certain new and useful improvements in **INTEGRATED CIRCUIT FERROELECTRIC MEMORY DEVICES INCLUDING PLATE LINES DIRECTLY ON FERROELECTRIC CAPACITORS AND METHODS OF FABRICATING THE SAME** for which an application for United States Letters Patent has been filed, or is being filed concurrently, in the United States Patent and Trademark Office. We hereby authorize and request Myers Bigel Sibley & Sajovec, P.A., to insert here in parentheses (Application No. _____, filed _____) the filing date and application number of said application when known or to file this Assignment concurrently with the application; and

WHEREAS, Samsung Electronics Co., Ltd., a Korean corporation having a principal place of business at 416 Maetan-dong, Paldal-gu, Suwon-City, Kyungki-do, Republic of Korea, hereinafter referred to as assignee, is desirous of acquiring the entire right, title and interest in and to said invention as described in said application, and in and to any and all Letters Patent which shall be granted therefor in the United States of America and all foreign countries;

NOW, THEREFORE, To Whom It May Concern, be it known that for good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, we have sold and by these presents do hereby sell, assign, transfer, and convey unto the said assignee, its successors and assigns, the entire right, title, and interest in and to the said invention and application, and in and to any and all continuations, continuations-in-part, or divisions thereof, and in and to any and all Letters Patent of the United States of America and all foreign countries or reissues or other forms of protection thereof which may be granted therefor or thereon, for the full end of the term for which said Letters Patent may be granted along with any term extensions thereon or therefor, together with the right to claim the priority of said application in all foreign countries in accordance with the International Convention, the same to be held and enjoyed by said assignee, its successors and assigns, as fully and entirely as the same would have been held and enjoyed by us if this assignment and sale had not been made.

We hereby request that said Letters Patent be issued in accordance with this assignment.

We further covenant and agree that, at the time of the execution and delivery of these presents, we possess full title to the invention and application above-mentioned, and that we have the unencumbered right and authority to make this assignment.

We further covenant and agree to promptly communicate to said assignee or its representatives any facts known to us relating to said invention, to testify in any interference or legal proceedings involving said invention, to execute any additional papers which may be requested to confirm the right of the assignee, its representatives, successors, or assigns to secure patent or similar protection for the said invention in all countries and to vest in the assignee complete title to the said invention and Letters Patent, without further compensation, but at the expense of said assignee, its successors, assigns, and other legal representatives; and we hereby instruct, and further covenant and agree to bind our heirs, legal representatives, and assigns, to do same, without further compensation, but at the expense of said assignee or its representatives.

IN WITNESS WHEREOF, we have hereunto set our hands and seals on this 14th day of January, 2002

Kim Hynn Ho (SEAL)
Hynn-Ho Kim

Kinam Kim (SEAL)
Ki-Nam Kim

Witnessed by:

_____

Date: _____

_____

Date: _____

US006388281B1

(12) **United States Patent**
Jung et al.

(10) **Patent No.: US 6,388,281 B1**
(45) **Date of Patent: May 14, 2002**

(54) **TRIPLE METAL LINE 1T/1C FERROELECTRIC MEMORY DEVICE AND METHOD FOR FABRICATION THEREOF**

(75) Inventors: **Dong-Jin Jung**, Suwon; **Ki-Nam Kim**, Kyunggi-do, both of (KR)

(73) Assignee: **Samsung Electronics Co. Ltd.**, Kyungki-do (KR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/617,912**

(22) Filed: **Jul. 17, 2000**

(30) **Foreign Application Priority Data**

Jul. 26, 1999 (KR) 99-30398

(51) **Int. Cl.**[7] **H01L 29/76**; H01L 27/108

(52) **U.S. Cl.** **257/295**; 257/295; 257/298

(58) **Field of Search** 257/295, 298, 257/303, 310; 438/3; 361/301.4

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Primary Examiner—Jerome Jackson, Jr.
Assistant Examiner—Joseph Nguyen
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(57) **ABSTRACT**

Disclosed is a triple metal line 1T/1C ferroelectric memory device and a method to make the same. A ferroelectric capacitor is connected to the transistor through a buried contact plug. An oxidation barrier layer lies between the contact plug and the lower electrode of the capacitor. A diffusion barrier layer covers the ferroelectric capacitor to prevent diffusion of material into or out of capacitor. As a result of forming the oxidation barrier layer, the contact plug is not exposed to the ambient oxygen atmosphere thereby providing a reliable ohmic contact between the contact plug and the lower electrode. Also, the memory device provides a triple interconnection structure made of metal, which improves device operation characteristics.

10 Claims, 8 Drawing Sheets